

The Dewey Burdock site is located in the SW corner of Custer County and the NW corner of Fall River County on the Wyoming/South Dakota border. In the southern Black Hills. About 45 miles west of the Pine Ridge Reservation. Very close to Cheyenne River which is a concern for Oglala Sioux and Cheyenne River Sioux Tribes since the Cheyenne River borders their reservations.

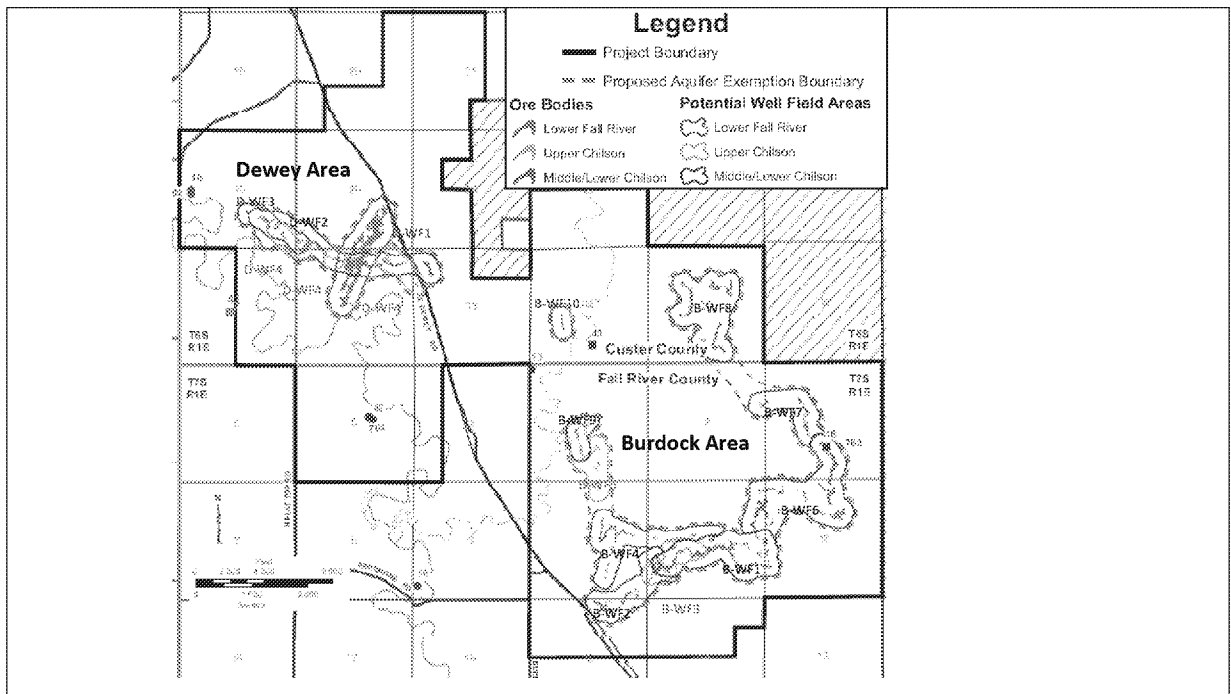
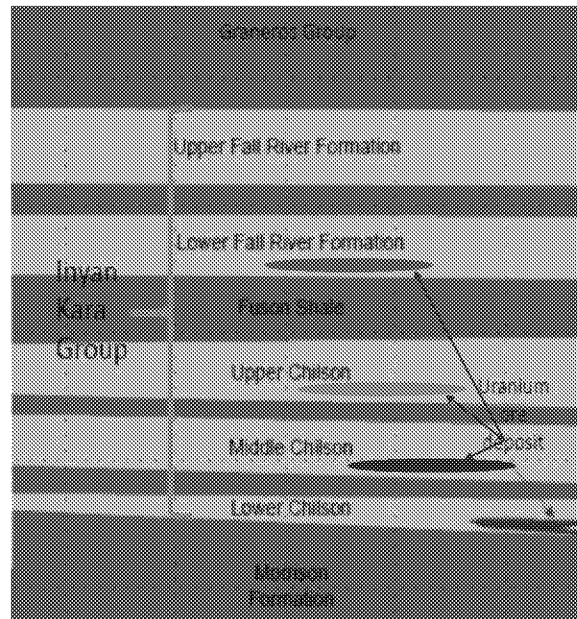
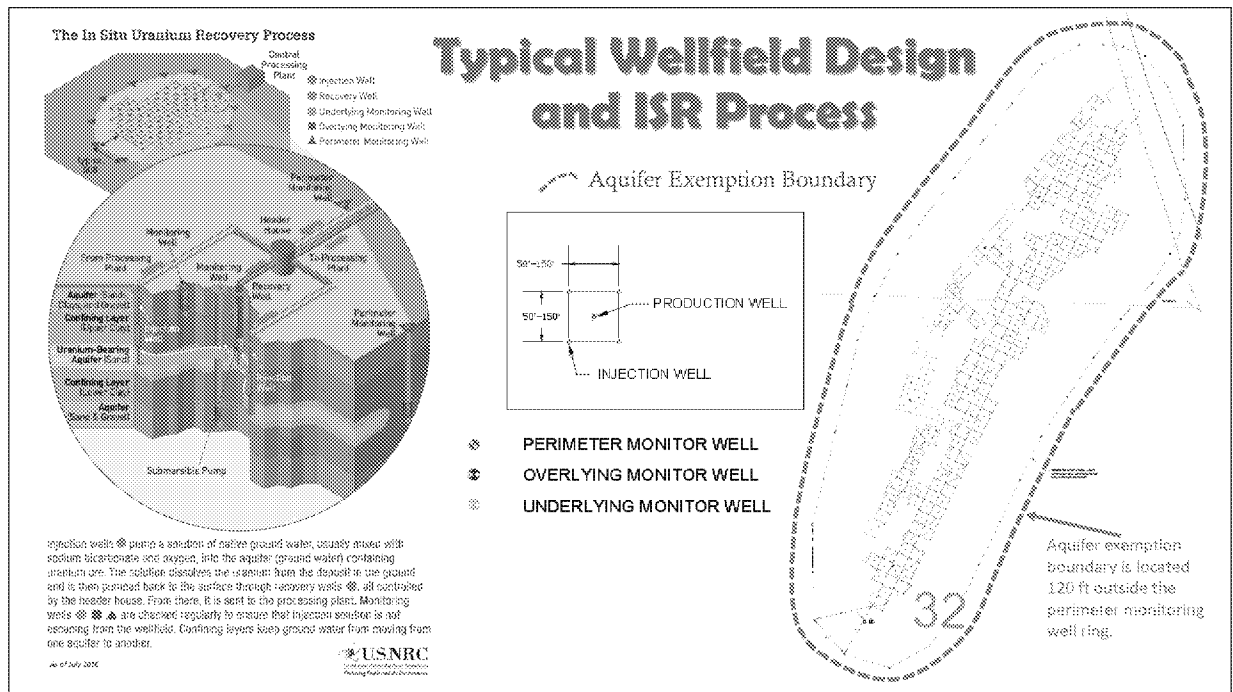


Figure 5 aquifer exemption boundary and exempted areas

## Cross Section of Ore Zones



Discuss the vertical extent of the aquifer exemption  
Explain the importance of the confining zones above and below the injection zones



Explanation of ISR process

Point out monitoring wells and explain function

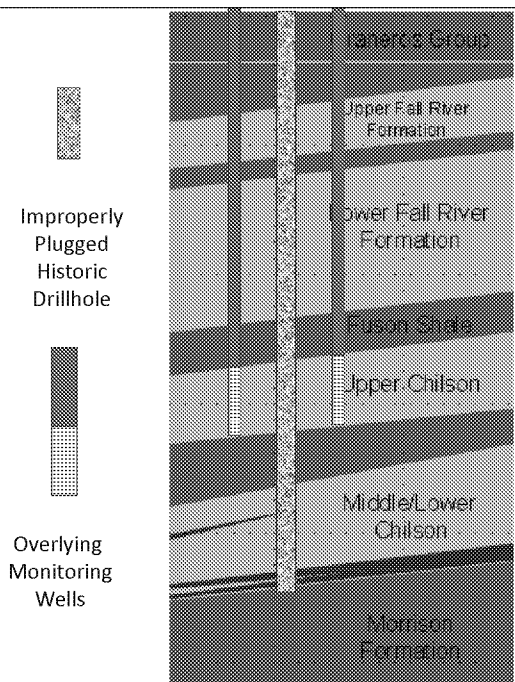
## **The permittee cannot commence injection right away after final permit issuance**

There are numerous requirements for rigorous geologic and hydrologic characterization in both permits to verify that injection activity will not cause migration of injectate into USDWs.

Class III permit requirements include (among many others):

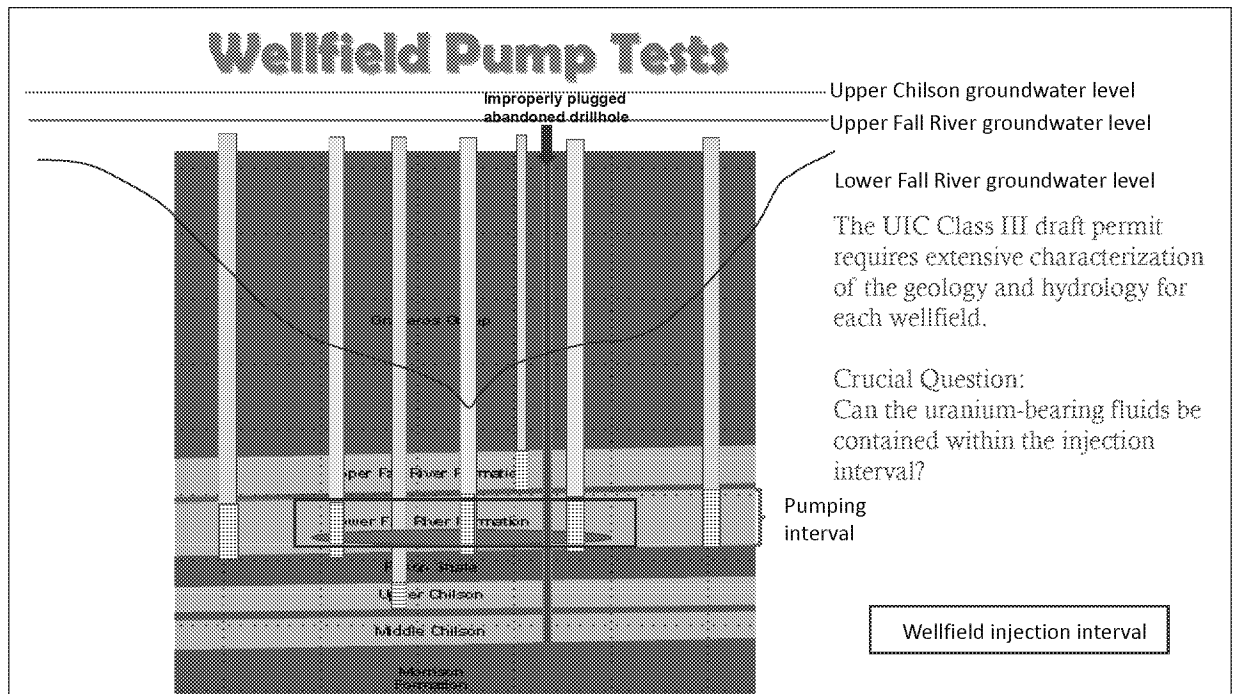
1. Map showing all plugged and abandoned exploration drillholes within the wellfield perimeter monitoring ring.
2. Identification of any exploration drillholes that had to be replugged.
3. Copies of any new or historic drillhole logs annotated to indicate presence of fault, fracture or joint for any drillholes located inside the perimeter monitoring well ring.
4. Mechanical integrity testing of monitoring wells, injection wells and recovery wells.

UIC regulations do allow ISR activities to occur in areas with breaches in the confining zones. In these situations, extra monitoring is required around the breaches.



Main Point: There is a way to conduct uranium recovery in areas where there are breaches in confining zones that is still protective of USDWs; this is how it works; and it is addressed in our regulations. Explain how monitoring around breaches in the confining zone works.

"Powertech will not be authorized to inject in any wellfield if it cannot demonstrate that USDWs will be protected during ISR operations, restoration, and post-restoration activities."



The wellfield pump test data must demonstrate vertical confinement to prevent movement of fluids out of the injection zone so that no USDWs are contaminated.

Wellfield pump tests are the best way to identify breaches in confining zones including fractures and improperly plugged abandoned historic drillholes.

The data must also demonstrate that it is possible to contain injection zone fluids horizontally to prevent contaminant migration into USDWs.

If a wellfield pump test shows a breach in a confining zone that cannot be located, reinjection of groundwater is another test method to help identify breaches in confining zones. The Class III permit contains requirements for both activities.

Emphasize: "Powertech will not be authorized to inject in any wellfield if it cannot demonstrate that USDWs will be protected during ISR operations, restoration, and post-restoration activities."

## Permit Conditions

### Wellfield Data Reports

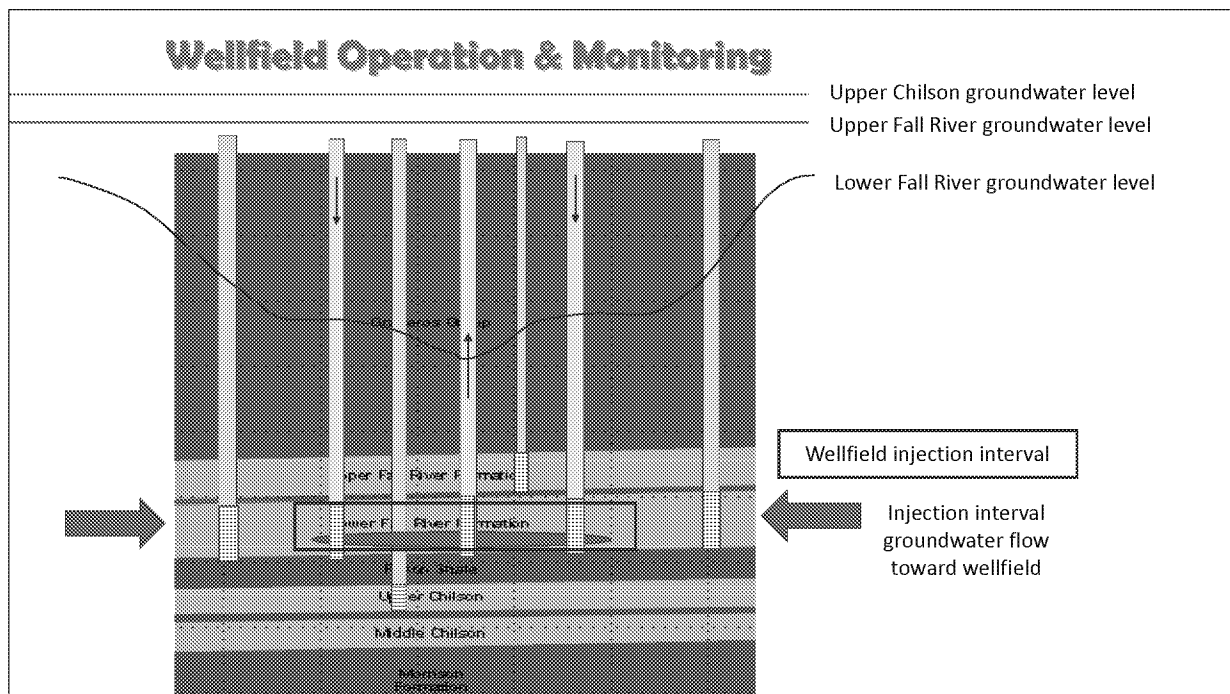
- Logging and testing procedures and results from delineation drillholes, wellfield wells and monitoring wells.
- Locations, logs and plugging records of exploration drill holes.
- Wellfield geologic cross section location map and geologic cross sections showing:
  - the top and bottom depths of the upper and lower confining zones across the wellfield;
  - the top and bottom depths of the injection interval across the wellfield; and
  - the top and bottom depths of the aquifer units overlying and immediately underlying the confining zones across the wellfield, excluding those below the Morrison Formation (lowest confining zone).
  - Descriptions of wellfield monitoring wells, including screened intervals, that will be used to demonstrate control of injectate and injection interval formation fluids throughout the ISR process and groundwater restoration.

Establishing injection pressure: Step Rate Tests

Mechanical Integrity Tests to make sure well construction does not compromise confining zones

### Monitoring:

- Hydraulic control or excursion monitoring
- Horizontal and Vertical excursions (injection zone and non-injection zone aquifer monitoring)
- Mechanical integrity



The Class III permit requires inward flow of groundwater toward the wellfield achieved by pumping out more groundwater than is being pumped back into the wellfield. This requirement remains in effect until the wellfield groundwater has been restored.

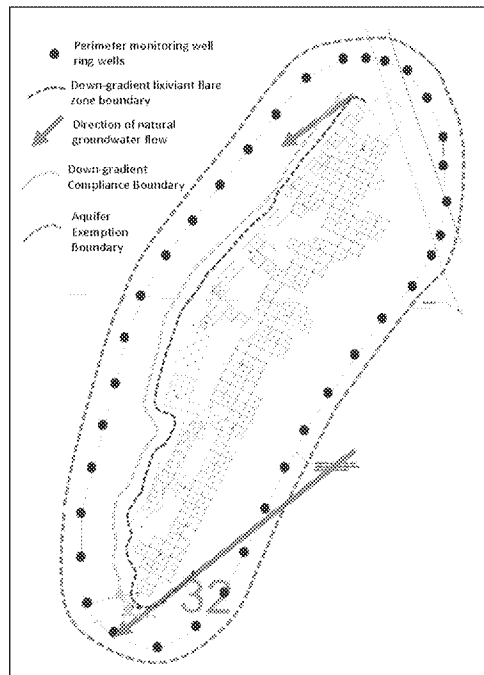


# Groundwater Restoration

- Establish baseline concentrations for mining contaminants before mining begins
- Groundwater restoration methods:
  - Groundwater sweep
  - Pump, RO treatment, reinject clean water
- Need Class I disposal well to dispose of RO reject
- Establish criteria for when restoration is complete
  - Example: Five samples over four consecutive quarters of mining contaminant concentrations within statistical range of baseline concentrations (Five samples)
  - No statistically significant increasing trend
- Stability monitoring phase

## First Draft Permit: Post-restoration Monitoring

1. Begins after wellfield restoration is complete.
2. Purpose: to demonstrate no ISR contaminants cross the aquifer exemption boundary.
3. The first Class III draft area permit required a proposed post-restoration monitoring plan before wellfield pump tests begin.
4. Post-restoration monitoring plan included establishing a down-gradient compliance boundary.
5. Groundwater baseline constituent concentrations were used as the permit limits for determining that no ISR contaminants cross the aquifer exemption boundary.
6. Baseline monitoring began before wellfield pump tests.
7. Baseline permit limits and strategy for detection of statistically significant increase of an ISR waste constituent above permit limits were based on the



Explain wellfield restoration – NRC regulated. EPA regulates USDWs outside AE boundary

The RCRA unified guidance describes statistical methods for establishing groundwater baseline concentrations and detection of contaminants. These methods have proven to be successful over several years of use under the RCRA program.

## **Second Draft Permit: Site Conceptual Model and Geochemical Modeling as part of the Wellfield Closure Plan**

### **Timing of the Wellfield Closure Plan.**

- When groundwater restoration begins in a wellfield, the Permittee shall use the results from the first set of water level and water quality samples collected from the injection interval monitoring wells during the restoration phase to update the CSM and use that data to calibrate the geochemical model for the wellfield.
- The Permittee shall continue to update the CSM and calibrate the geochemical model during groundwater restoration, including information on any flare zones or areas with high contaminant concentrations.
- Once restoration stability monitoring begins, the Permittee shall use the geochemical model to evaluate the geochemical stability of the restored ISR contaminant concentrations for comparison to observed concentrations during the restoration stability monitoring phase.
- After the restoration stability phase is completed and the geochemical model has been calibrated with the final set of monitoring data, the Permittee shall use the geochemical model to evaluate the long-term geochemical stability of the restored concentrations of ISR contaminants according to Section B of this Part.
- After the restoration stability phase is completed and the geochemical model has been calibrated with the final set of monitoring data, the Permittee shall conduct reactive transport modeling to evaluate the potential for ISR contaminants to cross the aquifer exemption boundary. This shall include reactive transport of post-restoration fluids in the wellfield downgradient toward the aquifer exemption boundary and reactive transport of upgradient groundwater into the restored wellfield and subsequently farther downgradient toward the aquifer exemption boundary.

## **Information needed for an Aquifer Exemption**

### **40 CFR § 146.4 Criteria for exempted aquifers.**

An aquifer or a portion thereof which meets the criteria for an “underground source of drinking water” in §146.3 may be determined under 40 CFR 144.8 to be an “exempted aquifer” if it meets the following criteria:

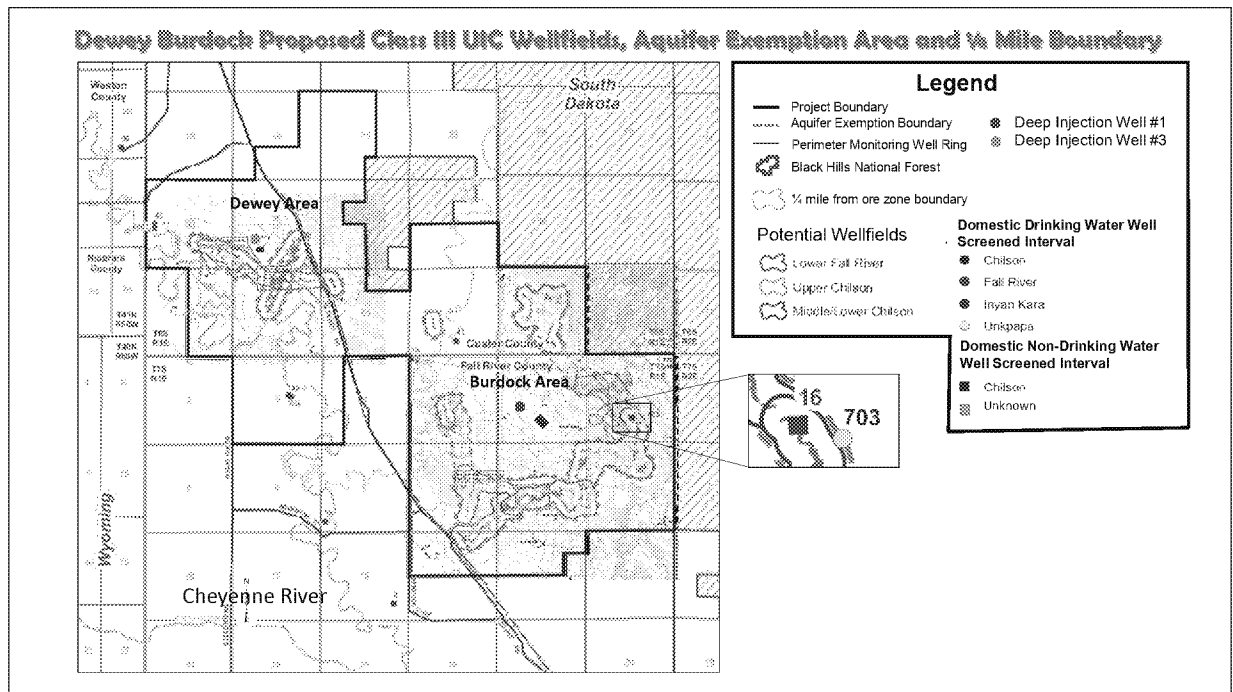
- (a) It does not currently serve as a source of drinking water; **and**
- (b) It cannot now and will not in the future serve as a source of drinking water because:
  - (1) It is mineral, hydrocarbon or geothermal energy producing, or can be demonstrated by a permit applicant as part of a permit application for a Class II or III operation to contain minerals or hydrocarbons that considering their quantity and location are expected to be commercially producible.

## **Information needed for an Aquifer Exemption**

### **40 CFR §144.7 Identification of underground sources of drinking water and exempted aquifers.**

**(c)(1)** For Class III wells, the Director shall require an applicant for a permit which necessitates an aquifer exemption under §146.4(b)(1) to furnish the data necessary to

- demonstrate that the aquifer is expected to be mineral or hydrocarbon producing.
- Information contained in the mining plan for the proposed project, such as
  - a map
  - general description of the mining zone,
  - general information on the mineralogy and geochemistry of the mining zone,
  - analysis of the amenability of the mining zone to the proposed mining method, and
  - a time-table of planned development of the mining zone
  - information required by §144.31(g) (*Information Requirements for Class I Hazardous Waste Injection Wells Permits*).



This map shows:

The project boundary (heavy black line)

The Black Hills National Forest land

The Dewey Area & Burdock areas

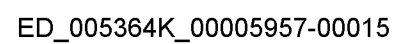
4 proposed wellfields in the Dewey Area

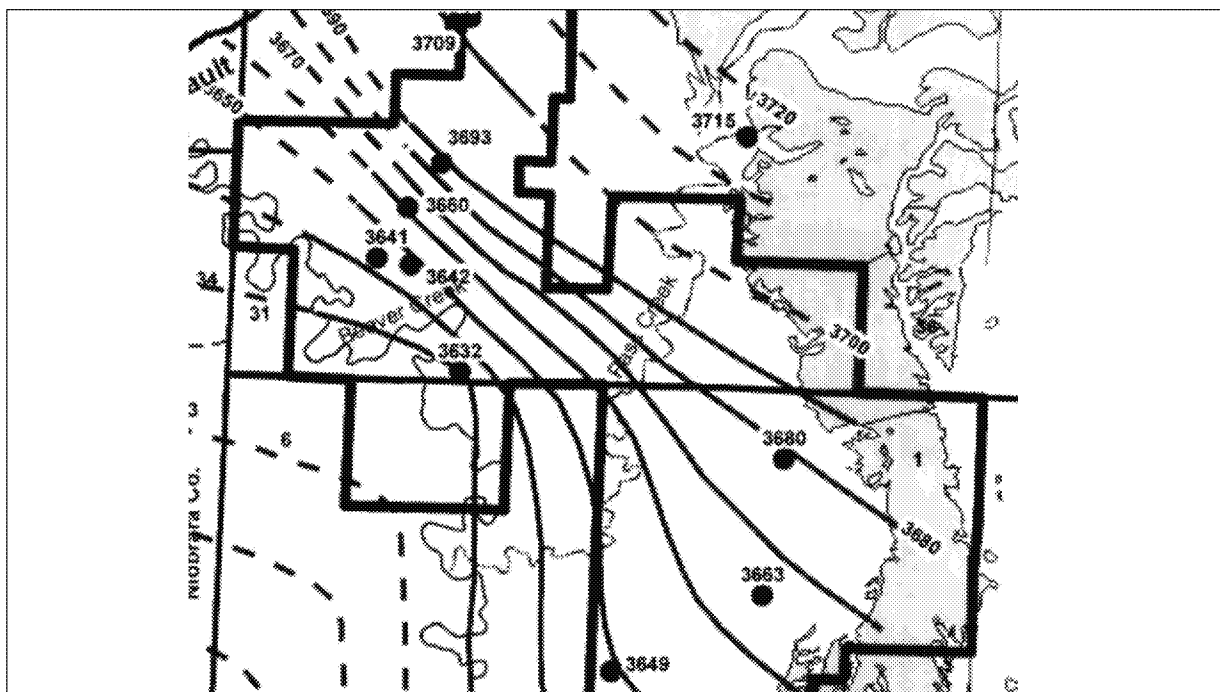
10 proposed wellfields in the Burdock Area

The Beaver Creek drainage tributaries that flow through the site to the Cheyenne River.

The enlarged square shows the location of the uranium ore deposits, the perimeter monitoring well ring and the aquifer exemption boundary 120 feet outside of perimeter monitoring well ring.

The wellfield colors represent the Inyan Kara aquifer targeted for uranium extraction (see next slide).





Fall River potentiometric surface map

For Goliad Uranium Energy Corporation measured the water level in 49 wells to create their potentiometric surface map. This map is based on 11 wells



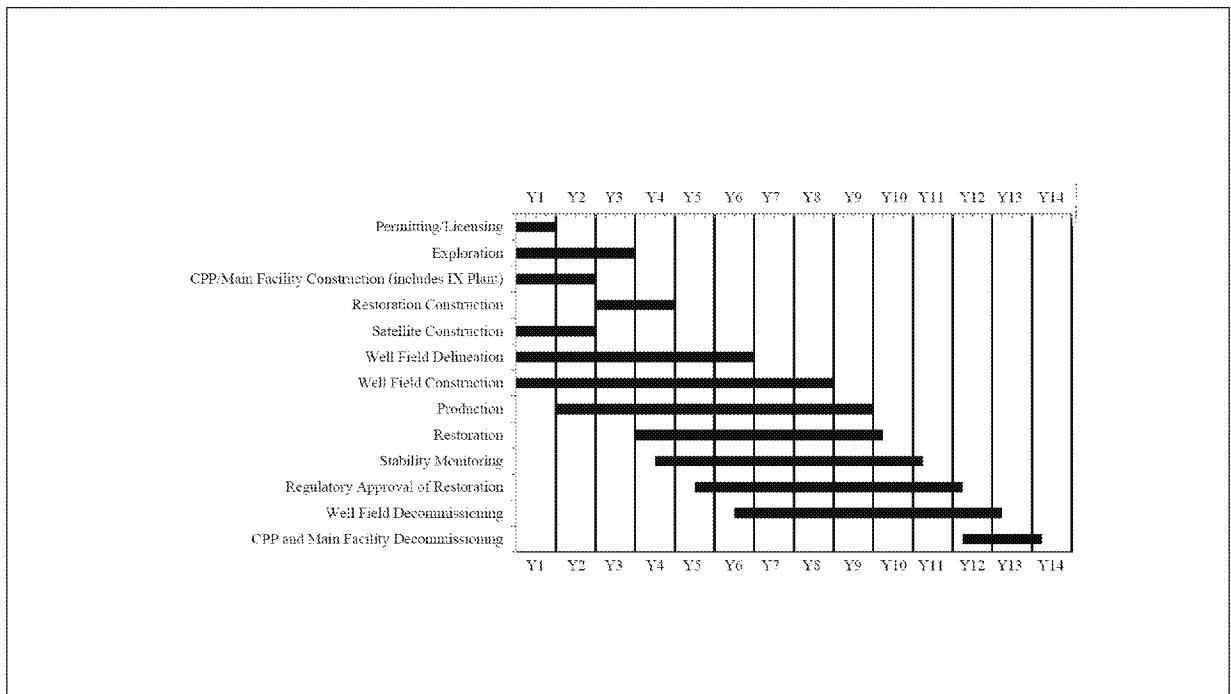


Figure 8  
Figure 10.2 of the Class III permit app showing Projected Construction, Operation and Decommissioning Schedule